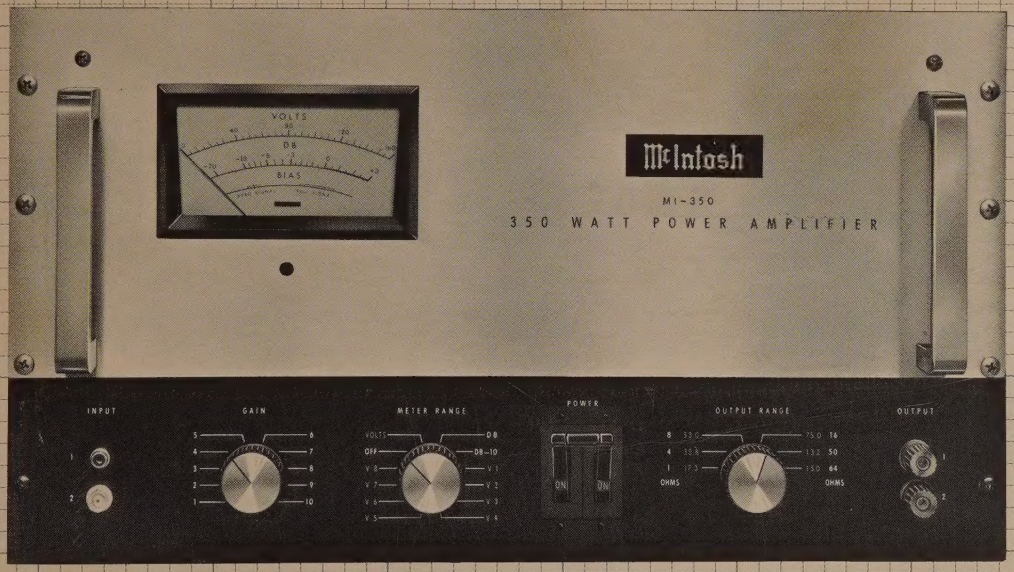

McIntosh

OWNER'S MANUAL

PRICE $1.25

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McIntosh is the Standard of Excellence because ....

The McIntosh "will to perfection" requires that we probe constantly into the unknown to bring the performance of our electronic equipment closer to perfection than ever before. This requires a constant and relentless search for low noise, broad band conservative design with an ever lower distortion factor. This is not required of ordinary equipment of average designs. It is, for us, a costly but worthwhile scientific and engineering effort. Our continuing research benefits our customers with the almost complete lack of obsolescence and the most reliable equipment ever made. It also means the lowest long-range cost to you. Nearly all of the McIntosh equipment ever made is still useable, or in use, though it may have been made twenty years ago.

McIntosh

MI-350

INDUSTRIAL POWER AMPLIFIER

350 WATT AUDIO AMPLIFIER

GENERAL DESCRIPTION

The McIntosh MI 350 is a high power amplifier for use in any high quality low distortion, high power application. The outstanding characteristic of this amplifier is the extremely low distortion at all power levels up to 350 watts from 20 Hz to 20 kHz. To achieve this performance the amplifier uses tubes in the audio circuits and solid state devices in the power supply as rectifiers and regulators. Solid state devices are also used in the meter circuits.

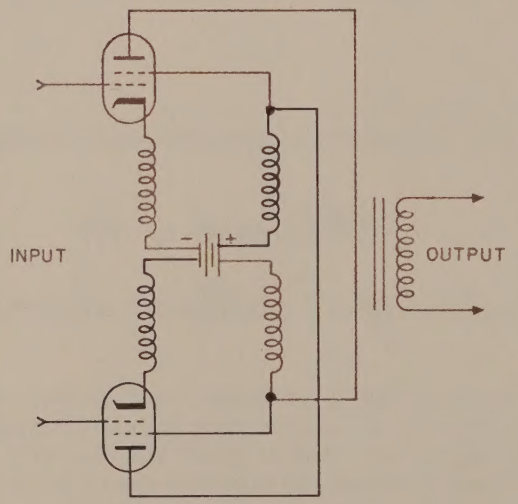
Input jacks and output terminals are located on the front panel and on the rear of the chassis. An input gain control can be used to set the right level of signal input. One of the special features of the MI 350 is the flexibility designed into the output circuit. A total of 6 output impedance and 6 output voltage taps are available; any one of which can be selected by a convenient front panel switch.

A front panel meter on the MI 350 can be used to indicate one of three operating conditions. The meter range switch selects the following:

1. The correct cathode current is indicated for the output tubes.
2. The voltage at the output terminals is indicated when the selector is turned to "Volts."
3. The short interval peak power output is indicated in decibels relative to 350 watts.

TECHNICAL DESCRIPTION

The MI 350 is an outstanding example of flexibility and utility of the basic McIntosh amplifier circuit patents. The McIntosh circiut was developed in 1947 at a time when high power, high efficiency and low distortion were impossible. A completely new engineering approach was used and the result was the first commercial power amplifier capable of 50 watts of power from 20 Hz to 20 kHz at less than 1% distortion over this entire frequency range. The MI 350 is another advance in McIntosh technology applied to circuits and transformers.



The MI 350 uses an advanced form of the basic patented McIntosh unity coupled output circuit and transformer. This arrangement loads the output tubes equally in both the anode and cathode circuits. It is this combination of McIntosh unity coupled circuit and transformer which eliminates output stage distortion due to quasi-transients found in conventional circuits.

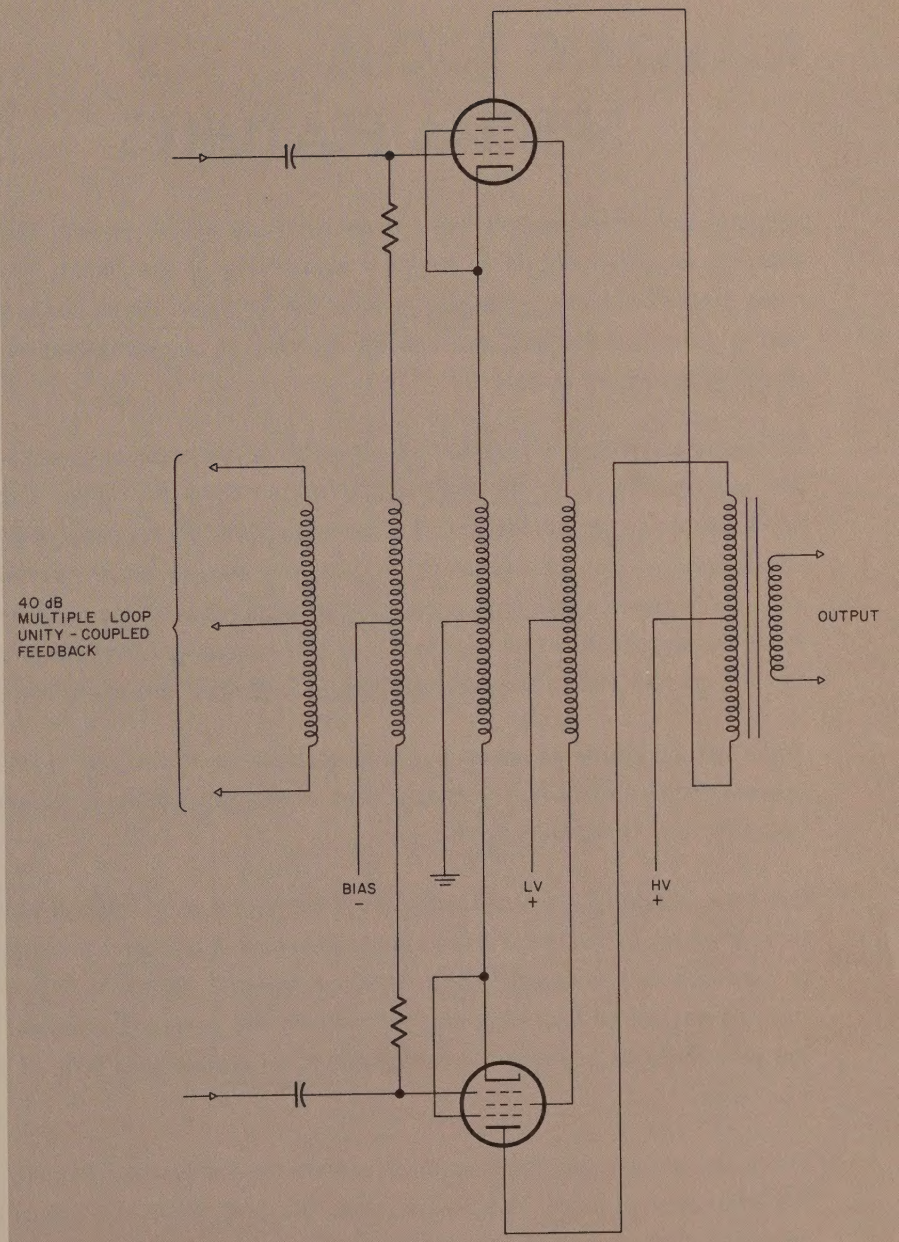
1. The MI 350 output transformer uses a Pentafilar winding arrangement. The primary has 5 different filar windings. One of the windings is used in the cathode circuit of the output tubes. A second winding is used in the plate circuit of the output tubes. A third and fourth winding are used to properly connect the bias and screen grid voltages to the output and driver stages. The fifth winding supplies the feedback signal for two negative feedback loops. In

this UNITY COUPLED feedback, one loop is the push-pull coupling to the balanced driver stage. The other, the main feedback loop, couples the feedback winding to the input differential amplifier. The PENTAFILAR windings are all wound on the transformer at the same time. This winding technique, developed and perfected by McIntosh, results in extremely tight coupling which reduces leakage inductance.

2. A greater amount of negative feedback can be obtained in an amplifier using primary feedback. The stability of the amplifier is not affected. If the feedback winding is wound filarly with the primary and has the same number of turns, the feedback winding will have phase and voltage as the primary windings for frequencies up to 500 kHz. As such, it is UNITY COUPLED with the primary.

3. By using UNITY COUPLED negative feedback, it is possible to obtain up to 40 dB of feedback with very good stability and extremely low non-linear distortion. It is relatively easy to maintain a flat frequency response with very low phase shift in the electronic circuits of an amplifier prior to the output transformer. The high quality performance is now delivered to the output load with the use of the UNITY COUPLED PENTAFILAR McIntosh output transformer.

4. To achieve flat frequency response well beyond 20 kHz, very close coupling is required between the primary and secondary windings in the output transformer. McIntosh accomplishes this by dividing the PENTAFILAR primary into 10 different winding sections. The secondary is divided into 8 different winding sections. These winding sections are then interleaved. This expensive and difficult winding method provides optimum coupling and holds the shunt capacity to a minimum.



SPECIAL FEATURES

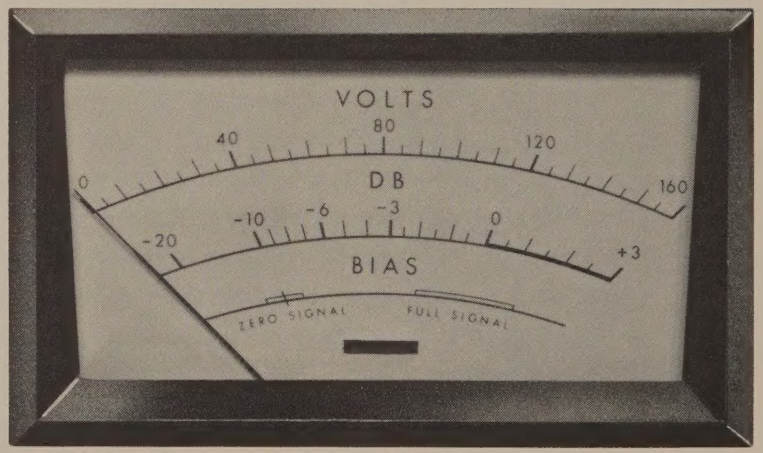
Magnetic circuit protectors have been provided in the MI 350. In the event of severe overload or extreme overdriving of the output tubes, these protectors turn off the AC power to the amplifier. When the condition is corrected the amplifier can be returned to normal operation by resetting the on-off switch.

To ensure long life and trouble-free operation a low noise maintenance-free fan has been built into the MI 350. The fan cools the output stages and provides cooler operation of the entire amplifier. In the event that air circulation for the fan is cut off, or if for any reason the temperature should rise above a safe limit, a thermal protector turns off the AC power. When the temperature has returned to a safe operating level, the amplifier can be returned to normal operation by turning on the power switch.

There are a number of power supplies used in the MI 350, all of which use solid state rectifiers. The output tube screen grid supply is specially regulated and electronically filtered.

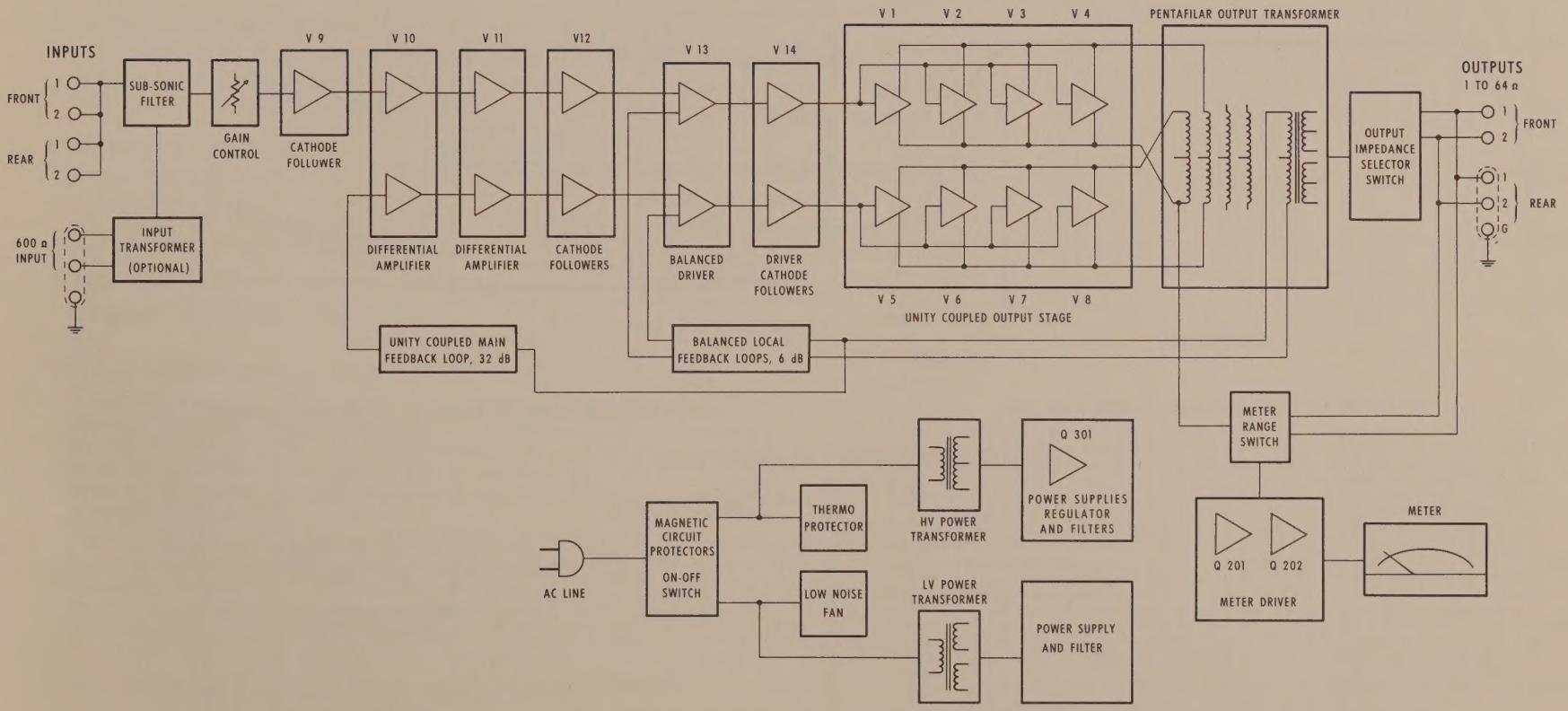
Ordinary meters lack the capabilty of indicating the short interval power in a sound wave. The mass of the meter movement is too great to respond to instantaneous changes in music program material. McIntosh engineering has developed new circuitry that permits the meters to respond to the short interval power in a sound wave to an accuracy of 98% of the true value.

There are two circuits that give these meters the indicating capability of the short interval power in a sound wave. The first circuit is an accelerating circuit that compensates for the inertia characteristics of the meter

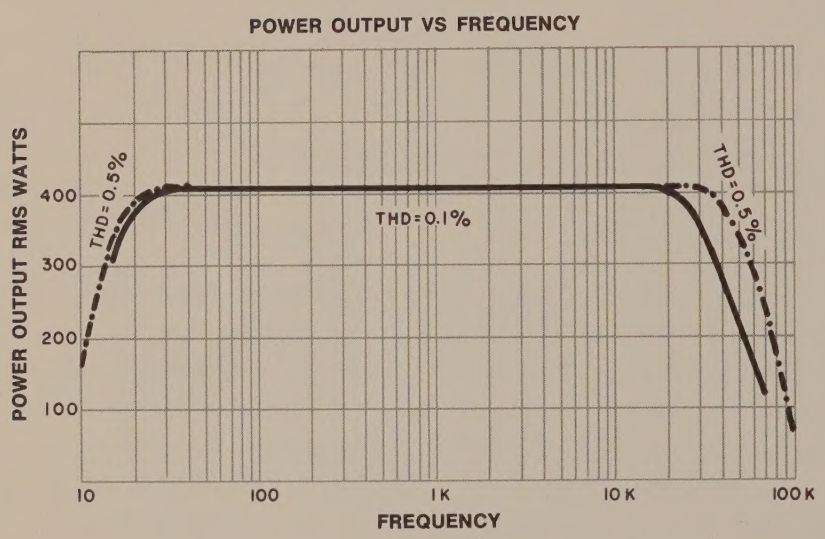


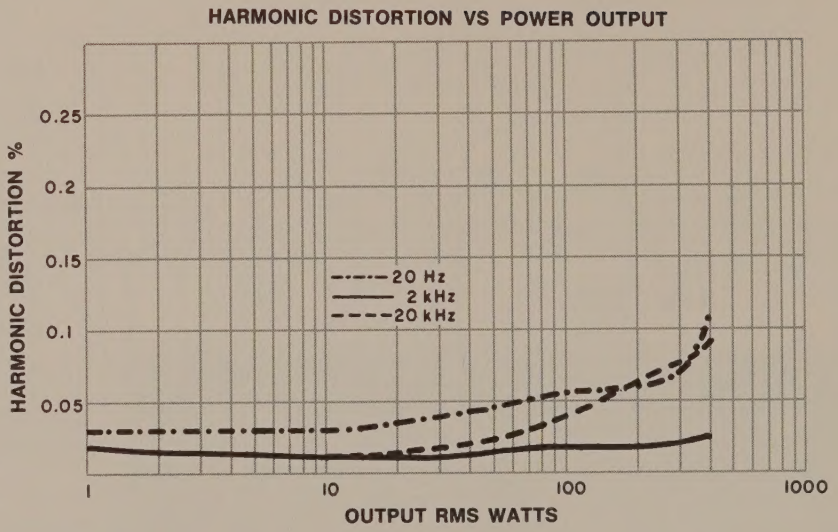
movement. Because the short interval power fluctuation is so rapid, the eye might not perceive the instantaneous power reading. This caused the development of the second circuit, which is a time stretching circuit. The peak readings of the meter are delayed a few milliseconds, by the time stretching circuit, to give the eye time to see the readings. The Dynamic Peak Locking Meter permits accurate monitoring of the short interval power in a sound wave.

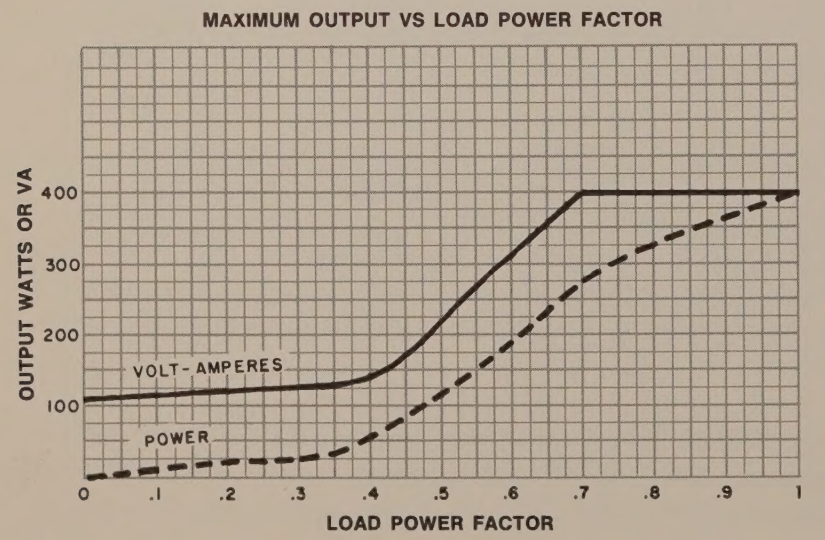
BLOCK DIAGRAM

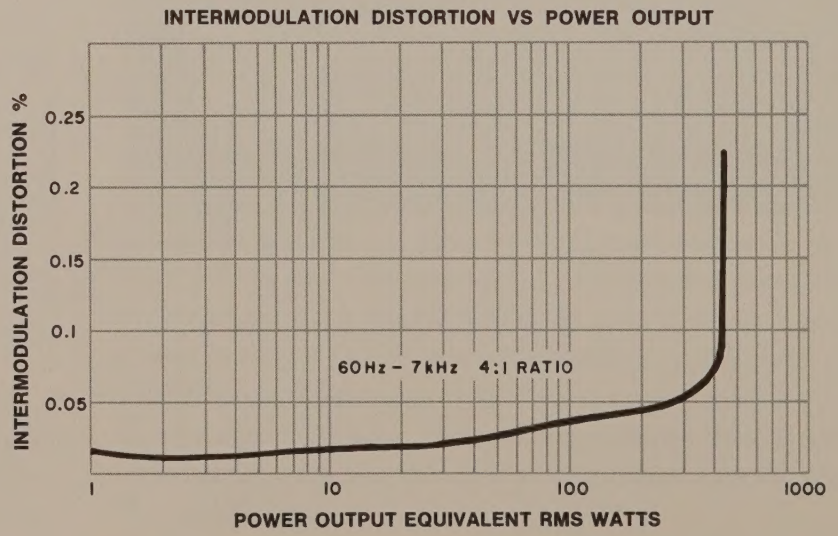


TYPICAL PERFORMANCE DATA









MI-350 SPECIFICATIONS

POWER OUTPUT:

350 RMS watts continuous.

HARMONIC DISTORTION:

Less than 0.15% at 350 watts power output from 20 Hz to 20 kHz. Typical performance is less than 0.1% at rated power. Distortion decreases as output power is reduced.

INTERMODULATION DISTORTION:

Less than 0.15% if instantaneous peak power output is 700 watts or less for any combination of frequencies 20 Hz and 20 kHz.

FREQUENCY RESPONSE:

AT RATED OUTPUT:
20 Hz to 20kHz +0 −0.5 db
AT REDUCED OUTPUT:
1 Hz to 70 kHz +0 −3.0 db at 1 watt

NOISE AND HUM:

95 db or more below rated output.

OUTPUT IMPEDANCES and VOLTAGES:

1 ohm/17.3 volts, 4 ohms/35.8 volts, 8 ohms/53 volts, 16 ohms/75 volts, 50 ohms/132 volts, and 64 ohms/150 volts. May be operated isolated from ground. (1 ohm/17.3 volt output is rated to 300 watts, and 4 ohm/35.8 volt output is rated to 320 watts.)

The 75 volt output is used to power 70.7 volt sound distribution lines. The 150 volt output is used to power 141.4 volt distribution lines. The 132 volt output is used to provide 117 volt for laboratory or industrial applications.

INTERNAL IMPEDANCE:

About 5% of rated load impedance. The 1 ohm/17.3 volt output is rated about .1 ohm.

INPUT IMPEDANCE:

200,000 ohms
(600 ohms with accessory M 107 McIntosh input transformer)

INPUT SENSITIVITY:

1.1 volts. Level control provided for higher input voltage.
(−8 dBM with accessory M 107 McIntosh input transformer)

POWER REQUIREMENT:

117 volts AC 50/60 Hz, 400 watts at zero signal output, 900 watts at rated output.

SOLID STATE COMPLEMENT:

3—Silicon Transistors
2—Silicon Zener Diodes
3—Germanium Diodes
9—Silicon Rectifiers and Diodes

TUBE COMPLEMENT:

2—12AX7
2—6DJ8
1—6CG7
1—6BL7
8—6LQ6

MECHANICAL SPECIFICATIONS

DIMENSIONS:

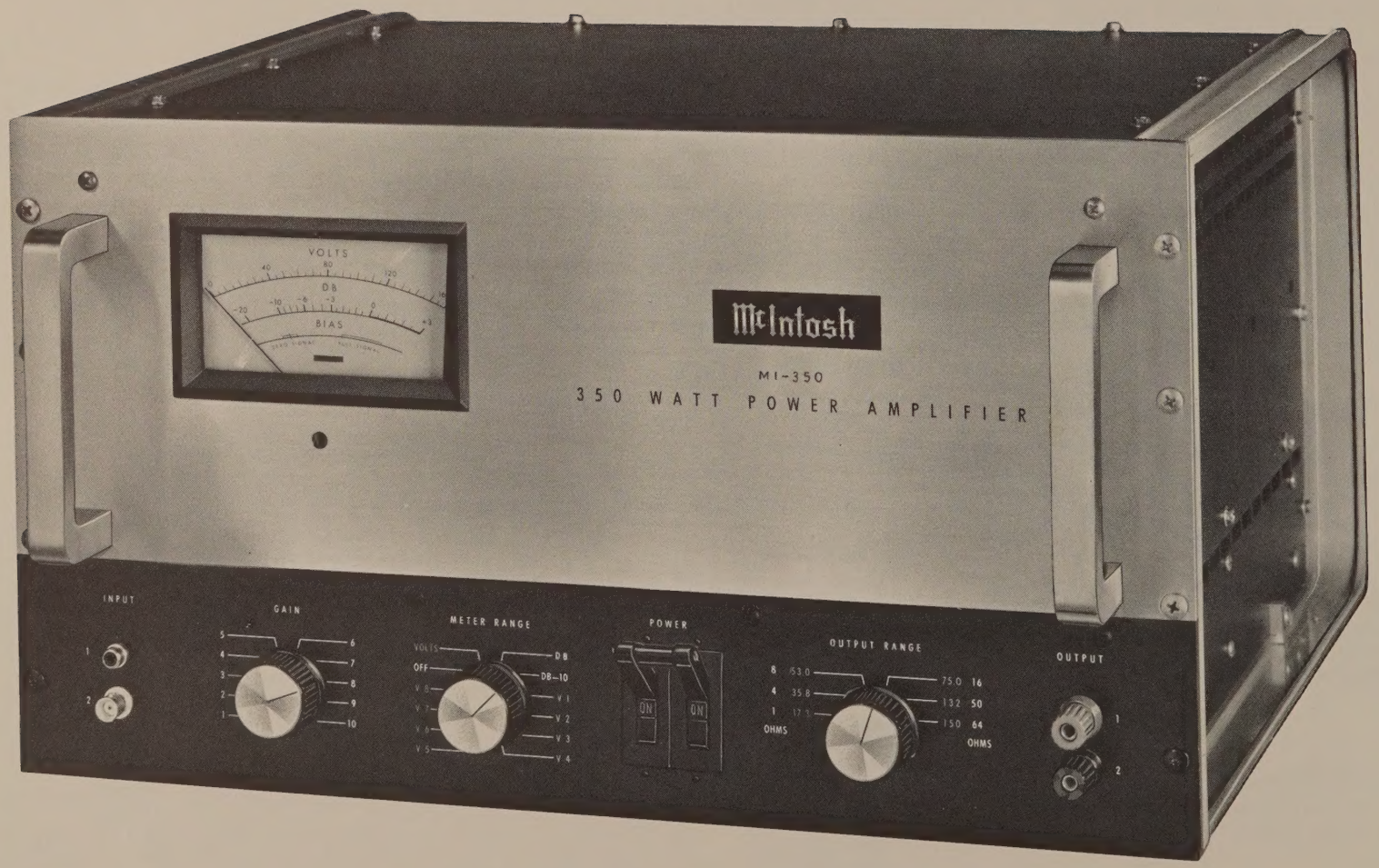
Front Panel — 10½ inches high x 19 inches wide
Chassis — 17 inches behind panel including connections
Knobs project 2 inches in front of panel

FINISH:

Front Panel — Anodized aluminum and black
Chassis — Chrome and black

WEIGHT:

Chassis only — 125 pounds. In shipping crate 135 pounds.


VOLTS
DB
BIAS
McIntosh
MI-350
350 WATT POWER AMPLIFIER
INPUT
GAIN
METER RANGE
POWER
OUTPUT RANGE
OUTPUT
ON
OHMS

FRONT PANEL INFORMATION

INPUT

HIGH IMPEDANCE:

Two sets of high impedance input connections have been provided. One set is on the right side of the back panel of the unit. The other set is located on the left side of the front panel. The two sets of connectors are connected in parallel. There are two types of input connectors in each set. One is the RCA phono type; the other is BNC connector.

The input sensitivity is 1.1 volts, for 350 watts output. The input impedance is 200,000 ohms. A gain control permits the use of input signals up to 30 volts without overload.

The LOW FREQUENCY ROLL-OFF switch is located on the back panel of the MI 350. In the LOW-FREQUENCY ROLL-OFF position, the response is rolled off below 5 Hz. In the normal position the response is flat.

600 OHM:

In addition separate provision has been made on the back panel for an input of 600 ohms connected through a plug-in input transformer.

With the M 107 input transformer the input sensitivity is −8 dBM. The input impedance is 600 ohms.

METER RANGE

The METER RANGE switch has 12 positions. Eight positions are used to monitor the cathode current in each of the output tubes. Two positions are used to monitor output power levels. One position is used to monitor the AC output voltage delivery by the amplifier. In the VOLTS position the meter is connected as an average reading voltmeter calibrated in RMS volts. The last position turns the meter OFF. The color of the markings for each switch position corresponds to the color of the scales on the meter face.

POWER

The POWER switch (and circuit breaker) is ON in the up position and OFF in the down position.

OUTPUT RANGE

The OUTPUT RANGE switch has six positions. The switch connects the proper taps on the output transformer for the required impedance or voltage windings to the output connectors. Each position is marked in impedance and voltage.

OUTPUT

Two sets of output connectors have been provided. One set is located on the right side of the front panel. The other set is located near the center of the back panel. These two sets of output connectors are wired in parallel.

A ground connection has been provided on the barrier strip on the rear of the amplifier. The strap between the GND terminal and the COM terminal is provided to ground the secondary of the output transformer to the chassis for normal applications. If it is desirable to operate with the secondary of the output transformer ungrounded, the strap between the COM and GND terminals can be removed. The McIntosh MI 350 is designed to operate with the secondary of the output transformer either grounded or not grounded.

CONNECTIONS AND ADJUSTMENTS

CONNECTING THE MI 350

INPUT:

HIGH IMPEDANCE

Connect a high impedance signal source to either type connector on either the back panel or front panel. Any signal source with an output from 1.1 to 30 volts will drive the MI 350 to full output.

600 OHMS

An accessory input transformer must be used.

For 600 ohm signal source connect to the barrier strip on the back panel marked TRANSFORMER INPUT only. The input sensitivity is −8 dBM.

The input transformer is plugged into the socket provided underneath the chassis.

OUTPUT:

Connect the load to the OUTPUT barrier strip on the back panel or to the OUTPUT connectors on the front panel. In compliance with the National Electrical Code Class I Wiring must be used for any output connections of 100 volts or greater. For below 100 volts and for normal loudspeaker impedances Class II wiring may be used. Class II wiring is lamp cord, bell wire, or other wire with similar insulation. For the normally short distances of under 50 feet between the amplifier and speaker, #18 or larger can be used. For distances over 50 feet between the amplifier and speaker use larger wire.

ADJUSTMENTS

OUTPUT RANGE

Set the OUTPUT RANGE switch for the impedance that matches the load.

METER RANGE

Set the METER RANGE switch to off.

GAIN

Turn the GAIN control totally counterclockwise.

POWER

Put the POWER switch in the ON position.

CATHODE CURRENT CHECK

After a warm-up period of three minutes check the cathode current of each output stage.

Turn the METER RANGE switch to the V1 (Green) position. The meter should show a reading in the ZERO SIGNAL area on the bias scale. Repeat this procedure in each of the 8 METER RANGE switch positions (V1-V8).

ADJUSTING CATHODE CURRENT OF THE OUTPUT TUBES

If the meter indicates outside of the ZERO SIGNAL area bias adjustment for the proper reading is necessary. On the bottom cover of the MI 350 are eight holes marked BIAS ADJ. Each hole is marked with the V number of the corresponding output tube and for each position on the METER RANGE switch.

IMPORTANT: USE AN INSULATED SCREWDRIVER TO MAKE THESE ADJUSTMENTS.

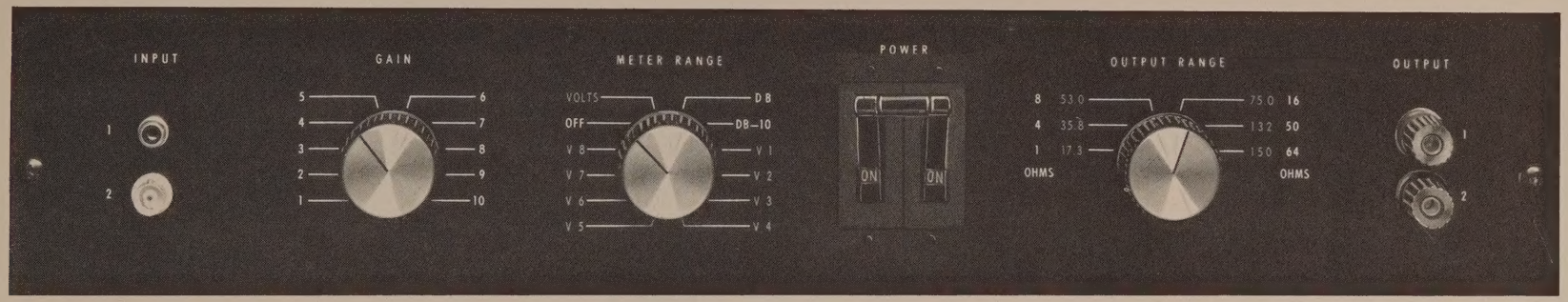
THESE ADJUSTMENTS ARE MADE WITH NO SIGNAL INPUT TO THE AMPLIFIER.

To adjust the cathode current, slowly rotate the control with the insulated screwdriver. Counterclockwise rotation decreases and clockwise increases. After making any adjustments check the reading on all other V positions of the METER RANGE switch.

MOUNTING

The MI 350 can be mounted in the conventional manner in a standard 19″ rack. The panel requires 10½″ of panel space. Be sure to allow 2″ in front of the panel for the knobs. The depth required is 17″ back of panel. Be certain to provide adequate ventilation.

OPERATING THE MI-350



Be sure the power switch is off (down).

1. Put "GAIN" control at minimum (1).

2. Connect signal source to the INPUT on either the front or back, but not both.

   If the optional low impedance transformer is used, connect a 600 ohm input to the TRANSFORMER INPUT on the back only. Be certain the input transformer has been firmly seated in its socket.

3. Connect the output load to the output terminals either on front or back.

4. Set "OUTPUT RANGE" switch to proper impedance for the load used. Never change the position of the output range switch when the amplifier is in operation.

5. Set "METER RANGE" switch to V1 position.

6. Insert AC plug into 117-125V, 50/60 Hz power source.

   (Do not put the power plug for this amplifier into any other McIntosh pre-amplifier, power amplifier or tuner receptacle. The connectors do not have sufficient power handling capacity and damage to the receptacle and equipment could result.)

7. Turn on "POWER" switch.

8. With "GAIN" control still at minimum, check V1 through V8 cathodes by switching "METER RANGE" switch to the successive indicated positions and noting meter reading on lower scale. If each reads within the indicated area you are ready to use the amplifier.

   NOTE: "METER RANGE" switch may be set to "VOLTS," "DB" or "DB-10" positions as desired for normal operation.

9. Advance volume control gradually and adjust to suit application.

Your MI-350 power amplifier will give you many years of pleasant and satisfactory performance. If you have any questions concerning the operation or maintenance of this amplifier please contact your dealer or: —

CUSTOMER SERVICE

McIntosh Laboratory Inc.
2 Chambers Street
Binghamton, N. Y. 13903
Our telephone number is
607-723-3512

MI-350 GUARANTEE

McIntosh Laboratory Incorporated guarantees this equipment to be capable of performance as advertised. We also guarantee the mechanical and electrical workmanship and components of this equipment to be free of defects for a period of 90 days from date of purchase. This guarantee does not extend to components damaged by improper use nor does it extend to transportation to and from the factory.

McIntosh

MI-350

McIntosh

McINTOSH LABORATORY INC.
2 CHAMBERS ST., BINGHAMTON, N. Y. 13903
607-723-3512

Design subject to change without notice.
Printed in U.S.A.
038-243